COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

This instruction implements AFPD 16-10, *Modeling and Simulation (M&S) Management*. It describes the concept and philosophy that underpin the AFSAT. It prescribes and explains the procedures and criteria for entering new models into the AFSAT and for retiring models from the AFSAT. It assigns responsibilities for AFSAT management and covers the policies and procedures that govern the management of the AFSAT. It applies to all Air Force organizations and personnel managing or using tools in the AFSAT or proposing new tools for entry into the AFSAT. This Instruction does not apply to the Air Force Reserve Command, but does apply to the Air National Guard. Ensure that all records created as a result of processes prescribed in this publication are maintained in accordance with AFMAN 37-123, (will convert to 33-363) *Management of Records* and disposed of in accordance with the *Air Force Records Disposition Schedule (RDS)* located at **https://afrims.amc.af.mil**. Refer changes and conflicts between this and other publications to the OPR at HQ USAF/A9IT, 1570 Air Force Pentagon, Washington, DC 20330-1570, on Air Force (AF) Information Management Tool (IMT) 847, **Recommendation for Change of Publication**. Send an information copy to HQ AFCA/EASD, 203 West Losey Street, Room 1100, Scott AFB, IL 62225-5233. Major commands, field operating agencies, and direct reporting units may supplement this instruction. They must send one copy of their published or posted supplement to the OPR at HQ USAF/ A9IT and a courtesy copy to HQ AFCA/EASD.

See **Attachment 1** for a glossary of references, abbreviations, acronyms and terms.

Section A—AFSAT Background, Concept and Responsibilities

1. Background and Concept. Digital models and simulations are among the most valuable tools commonly used by the Air Force Analytic Community (AFAC). These tools are playing an increasingly important role in supporting analyses that underpin key programmatic and acquisition decisions and assess alternative warfighting concepts, doctrine, strategies, tactics, and courses of action. The AFSAT is a collection of analytic computer models accepted and recommended by the AFAC for analysis in support of decisions regarding strategic planning, capability requirements, and weapon systems development, acquisition, and testing.

1.1. Air Force M&S efforts are organized around four Thrusts or emphasis areas: Warfighter Readiness, Accelerated Acquisition, New and Emerging Warfighter Capabilities (NEWC), and M&S Foundations. The AFSAT supports all four Thrust areas, but is most closely related to the NEWC Thrust, which focuses on M&S employed by the Air Force analytic, wargaming, and experimentation communities. The AFSAT Manager (see paragraph **4.**) is also the co-chair of the NEWC Thrust Integrated Process Team (IPT). AFSAT models, among others, are also often employed to support the Accelerated Acquisition Thrust by providing tools that aid in requirements definition, capabilities assessment, concept exploration, and system design and evaluation.

1.2. AFSAT models currently span the engagement, mission and campaign levels of modeling, supporting Air Force strategic, operational and tactical level analysis requirements. The AFSAT is a common leveraging element in the employment of standard analysis practices and accepted tools that provide analytical insights for Air Force decision-makers. It is also a deliberate approach to publicize accepted models that address the goals of reducing proliferation of models, duplication of effort, and associated model ownership costs.

1.3. The AFSAT is centrally managed by HQ USAF/A9 under the auspices of the AFAC Steering Group (SG) with individual models managed by appropriate domain experts and model users. AFSAT models meet certain criteria (see **Attachment 2**) that provide users and accreditation officials confidence in model validity and credibility when used by appropriately trained staff.

2. AFAC SG. The AFAC SG is a Headquarters Air Force-chartered body that is chaired by the Director, Studies & Analyses, Assessments and Lessons Learned (HQ USAF/A9) and has membership consisting of representatives of Air Force analysis offices. The AFAC SG oversees AFSAT management and provides supplemental guidance to the AFSAT Manager, model management organizations (MMO), and individual model managers as required. The AFAC SG will designate a volunteer using organization, the MMO, to be responsible for management of each Air Force-owned AFSAT model in accordance with this AFI. The AFAC SG will decide what models are in the AFSAT based on the process defined in **Section B** and the set of criteria in **Attachment 2**. Where there are multiple versions of a given model, the AFAC SG will decide which version, if any, is in the AFSAT using this process. The AFAC SG will decide what models are retired from the AFSAT based on the process defined in **Section C** and the set of criteria in **Attachment 3**.

3. AFSAT Model Sponsor. Model sponsors are AFAC member organizations that nominate a model for entry into the AFSAT and continue as its advocate throughout the tenure of the model in the AFSAT. Normally the model sponsor is either the AFAC member organization that provides the model manager (i.e., the MMO), expends resources for model development, or is the primary model user.

4. AFSAT Manager. HQ USAF/A9I is the AFSAT Manager and manages the AFSAT on behalf of the AFAC SG in accordance with the policies, processes, and procedures herein and any supplemental guidance provided by the AFAC SG. The AFSAT Manager will maintain a list of AFSAT models, their MMOs, and individual Model managers and their contact information on the AFSAT section of the HQ USAF/A9 website at **https://www.afsaa.hq.af.mil**. The AFSAT Manager will coordinate with the Air Force Agency for Modeling and Simulation to ensure that the AFSAT is addressed in the Air Force Modeling and Simulation Resource Repository.

5. MMOs and Model Managers. The MMO for each AFSAT model will designate in writing to the AFSAT Manager one or more specific individuals to be the model manager, responsible for management of the AFSAT model in accordance with this instruction. The MMO will update this information to the AFSAT Manager when changes occur. Model managers will be cognizant of the AFSAT model entry criteria listed in **Attachment 2** in the course of managing and enhancing their models, recognizing that a deterioration of an AFSAT model's status relative to the entry criteria could undermine the justification for the model to be in the AFSAT and could result in a decision to retire it based on the process outlined in **Section C**.

6. AFSAT Model Users.

6.1. Prospective users of AFSAT models should contact the appropriate model manager for information regarding model availability, performance, and user requirements. A list of AFSAT model managers and their contact information is maintained by the AFSAT Manager on the AFSAT section of the HQ USAF/A9 website (**https://www.afsaa.hq.af.mil**).

6.2. Use of AFSAT models by AFAC organizations to conduct analysis is strongly encouraged from an Air Force M&S policy and an Air Force investment strategy viewpoint. Sponsors, users, and practitioners of analyses performed using non-AFSAT models should be prepared to defend investments in other models in functional Air Force corporate investment reviews and be aware that the analysis may be subject to increased scrutiny.

6.3. The selection and use of an AFSAT model for an analytic task does not relieve the using organization of the responsibility for accrediting the model for the specific intended use in accordance with AFPD 16-10, *Modeling & Simulation (M&S) Management* and AFI 16-1001, *Verification, Validation, and Accreditation (VV&A)*.

Section B—AFSAT Model Entry Policies, Processes and Procedures

7. Model Entry Nomination. The sponsoring organization (model sponsor) must nominate a candidate model for AFSAT entry to the AFSAT Manager (HQ USAF/A9I) in writing. The candidate model will then be evaluated for AFSAT entry using the process described in paragraphs **8.-11.** and illustrated in **Attachment 4**. Note that **Attachment 4** is a simplified illustration of the model entry process and does not cover the detailed procedures prescribed in paragraphs **8.-11.**.

8. Model Pre-Screening.

8.1. The model sponsor will submit a model pre-screening package (MPSP) to the AFSAT Manager (for required MPSP contents, see **Attachment 5**).

8.2. The AFSAT Manager will evaluate the MPSP against the mandatory AFSAT model entry criteria (**Attachment 2**).

8.3. The AFSAT Manager will estimate the resources required to complete the formal evaluation described herein in terms of people, time, and dollar cost, to include estimating the size and makeup (organizational membership) of the formal model evaluation team (MET).

8.4. The AFSAT Manager will endeavor to complete the model pre-screening evaluation (paragraph **8.2.**) and MET resources estimate (paragraph **8.3.**) in less than two months total.

8.5. The model sponsor will brief the candidate model to the AFAC SG.

8.6. The AFSAT Manager will brief the results of the pre-screening and the resources required for a full evaluation to the AFAC SG and either will recommend rejection of the candidate model for the AFSAT or formation of a MET and continuation of the model evaluation process.

8.7. The AFAC SG will decide whether to reject the candidate model for the AFSAT or to approve formation of a MET to continue the model evaluation process.

9. MET Formation and Preparation.

9.1. The AFSAT Manager will lead and coordinate the formation and preparation of the MET. The model sponsor will also be a member of the MET.

9.2. With the exception of the AFSAT Manager and the model sponsor, participation in the MET by AFAC member organizations is voluntary. The AFSAT Manager will recommend the organizational makeup of the MET team to the AFAC SG for its approval

9.3. Each MET member organization will be responsible for providing the resources required for their MET member to participate in the candidate model evaluation.

9.4. The MET will endeavor to complete its review in three months or less.

9.5. The MET will review the MPSP.

9.6. The MET will hold an internal "calibration meeting" to discuss MET purpose, AFSAT entry criteria, and to formulate questions that must be answered.

9.7. The MET will present its questions and issues to the model sponsor.

10. Candidate Model Presentation & Evaluation.

10.1. The model sponsor will present the case to the MET for AFSAT entry. The presentation must include each of the mandatory AFSAT model entry criteria (**Attachment 2**), a model demonstration, studies and associated results using the candidate model, current and prospective users, user testimonials, model verification and validation (V&V) information, and the model user support plan.

10.2. The MET will evaluate the candidate model against each mandatory AFSAT entry criterion (**Attachment 2**).

10.3. The MET will present the results of the model evaluation to the model sponsor and solicit feedback.

11. AFAC SG Model Entry Decision.

11.1. The MET will prepare and present a final briefing on the results of the model evaluation and the MET's recommendation to the AFAC SG.

11.2. The AFAC SG will decide whether to admit the candidate model to the AFSAT.

11.3. If the AFAC SG decides not to admit a candidate model to the AFSAT, the AFAC SG meeting minutes will document the rationale for that decision.

11.4. If, within three months of a non-admission decision by the AFAC SG, the model sponsor makes changes to the model and re-nominates it for AFSAT entry, the model entry process starting with paragraph **10.1.** through paragraph **11.2.** must be repeated. If more than three months passes from

non-admission decision to re-nomination for AFSAT entry, the entire model entry process must be repeated starting with paragraph **8.1.**

Section C—AFSAT Model Retirement Policies, Processes and Procedures.

12. Biennial AFSAT Model Review. Every two years the AFSAT Manager will conduct a review of the latest officially released versions of the models in the AFSAT and based on this review prepare a Model Retirement Candidate List (MRCL). Reasons for placing an AFSAT model on the MRCL are listed in **Attachment 3**. When releasing new versions of models currently in the AFSAT, model managers and model sponsors should be mindful not to degrade their model's status relative to the criteria in **Attachment 3**. The AFSAT Manager will inform model sponsors when their models are on the MRCL. The AFSAT Manager will annotate the MRCL with the model sponsors' positions on the proposed retirement of their models from the AFSAT.

13. Biennial Model Retirement Recommendation. The AFSAT Manager will recommend actions indicated by the biennial review to the AFAC SG. Model sponsors who disagree with retiring their models from the AFSAT can make their case to the AFAC SG.

14. Out-of-Cycle Model Retirement Nomination, Review and Recommendation.

14.1. Model sponsors may at any time nominate their model to be retired from the AFSAT to the AFSAT Manager. In such cases, the AFSAT Manager will conduct an out-of-cycle review of the model nominated for retirement.

14.2. Based on this review, the AFSAT Manager will recommend retirement or retention of the model to the AFAC SG.

15. Model Retirement Decision. The AFAC SG will decide to retire or retain AFSAT models recommended for retirement by the AFSAT Manager whether based on the biennial review or an out-of-cycle review. The AFAC SG, may, at its discretion, not take an immediate decision, but instead direct the formation of a MET to conduct a formal model evaluation and make a retirement or retention recommendation back to the AFAC SG for subsequent decision.

16. Form Adopted. AF IMT 847, *Recommendation for Change of Publication*.

JACQUELINE R. HENNINGSEN, PhD, SES
Director, Studies & Analyses, Assessments and Lessons Learned

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

DODD 5000.59, *DoD Modeling and Simulation (M&S) Management*, 4 January 1994

DOD 5000.59-M, *DoD Modeling and Simulation (M&S) Glossary*, January 1998

DODI 5000.61, *DoD Modeling and Simulation (M&S) Verification, Validation, and Accreditation (VV&A)*, 13 May 2003

AFPD 16-10, *Modeling and Simulation (M&S) Management*

AFI 16-1001, *Verification, Validation and Accreditation (VV&A)*

AFI 16-1002, *Modeling and Simulation (M&S) Support to Acquisition*

AFI 33-202, Volume I, *Network and Computer Security*

AFMAN 37-123, (will convert to 33-363), *Management of Records*

Abbreviations and Acronyms

AF—Air Force

AFAC—Air Force Analytic Community

AFB—Air Force Base

AFCA—Air Force Communications Agency

AFI—Air Force Instruction

AFMAN—Air Force Manual

AFPD—Air Force Policy Directive

AFSAT—Air Force Standard Analysis Toolkit

DC—District of Columbia

DOD—Department of Defense

DODD—Department of Defense Directive

DODI—Department of Defense Instruction

HQ—Headquarters

IL—Illinois

IMT—Information Management Tool

IPT—Integrated Process Team

MET—Model Evaluation Team

MMO—Model Management Organization

MPSP—Model Pre-Screening Package

MRCL—Model Retirement Candidate List

M&S—Modeling and Simulation

NEWC—New and Emerging Warfighter Capabilities

OPR—Office of Primary Responsibility

PhD—Doctor of Philosophy

RDS—Records Disposition Schedule

SAF—Secretary of the Air Force

SES—Senior Executive Service

SG—Steering Group

USAF—United States Air Force

V&V—Verification and Validation

VV&A—Verification, Validation and Accreditation

WWW—Worldwide Web

Terms

Accelerated Acquisition M&S Thrust—The M&S Thrust that encompasses M&S focused on reducing the time and resources required to provide material solutions to the warfighter, including support for design and development, testing, certification, and logistics and maintainability across the lifecycle of a system.

Accreditation—Official determination that a model or simulation is acceptable for use for a specific purpose.

Air Force Standard Analysis Toolkit—The standard toolkit of models used by the AFAC to aid in shedding light on Air Force problems, answering senior decision maker questions, and analyzing alternative systems and courses of action.

Campaign Model—A model that attempts to capture all important aspects of aerospace power over the duration of a conflict across an entire theater or theaters of operation in a force vs. force campaign length scenario.

Configuration Management—Application of technical and administrative direction and surveillance to identify and document the functional and physical characteristics of a model or simulation, control changes, and record and report change processing and implementation status.

Engagement Model—A model that provides measures of effectiveness at the system level of representation by evaluating system effectiveness against enemy systems in a one-on-one or few-on-few combat scenario.

Integrated Process Team—A means to achieve concurrent engineering. They are multidisciplinary teams consisting of representatives from all relevant disciplines.

M&S Thrust—The Air Force organizes its M&S activities into four *thrusts* or areas of interest:

Warfighter Readiness, Accelerated Acquisition, New and Emerging Warfighter Capabilities, and M&S Foundations. M&S Thrusts marshal similar elements into cohesive, synergistic groupings. They provide a manageable mechanism for identifying M&S requirements while avoiding overlap, duplication, gaps and seams.

M&S Foundations Thrust—The M&S Thrust that encompasses M&S tools and technologies needed to improve the usefulness, productivity, scalability, or efficiency of M&S from across all of the Thrusts, including information technology, architectures, databases, standards, inter-operability, inter-connectivity, and consistent synthetic environments.

Mission Model—A model that captures one or more interacting aspects of aerospace power during the course of representing an aerospace mission or missions by evaluating mission effectiveness against enemy forces in a few-on-few or many-on-many combat scenario.

Model—A physical, mathematical, or logical representation of a system entity, phenomenon, or process.

Model User Support Plan—The model sponsor's plan for supporting users of the model if it is admitted to the AFSAT.

New and Emerging Warfighter Capabilities M&S Thrust—The M&S Thrust that encompasses support for the formulation, exploration and evaluation of new and emerging warfighter capabilities through analysis, wargaming, and warfighting experimentation.

New and Emerging Warfighter Capabilities M&S Thrust Integrated Process Team—The Integrated Process Team associated with the NEWC Thrust. Each M&S Thrust has an associated Thrust IPT: a multidisciplinary body that develops and implements crosscutting standards, resource strategies, and modernization programs requiring an overarching integration process.

Simulation—A method for implementing a model over time for the purpose of testing, analysis, or training.

Validation—Rigorous and structured process of determining the extent to which M&S accurately represents the intended "real-world" phenomena from the perspective of the intended M&S use.

Verification—Process of determining that M&S accurately represents the model developer's conceptual description and specifications.

Warfighter Readiness M&S Thrust—The M&S Thrust that encompasses support for improved wartime decision-making, skills, and processes, including exercises, operational training, mission rehearsal, operational decision support, and concept development.

Attachment 2

AFSAT MODEL ENTRY CRITERIA

A2.1. Does the candidate model provide data, answers, or insights that address a critical Air Force analytic capability?

A2.1.1. Does the model provide a capability not currently in the toolkit?

A2.1.2. For what studies has the model been used?

A2.1.3. What Air Force-level decisions has the model supported or impacted?

A2.1.4. Do the model's capabilities overlap those of other models in the toolkit?

A2.1.5. Could this model replace a current toolkit model?

A2.1.6. What level of analysis does this model support (campaign, mission, engagement, other)?

A2.1.7. Does the analysis supported by this model impact a significant segment of the AFAC?

A2.2. Does the candidate model have adequate documentation?

A2.2.1. Is there enough information for the evaluation team to knowledgeably evaluate the model?

A2.2.2. Is there enough documentation for an analyst to use the model within its valid bounds?

A2.2.3. Does the analyst's or user's manual describe the major model algorithms, algorithm and data relationships, input data requirements, and output data?

A2.2.4. Are there sample input-output data files and does the documentation describe how to organize, analyze and transform the model output into credible, actionable information?

A2.3. Is there a functioning and documented model configuration management process?

A2.3.1. Is there a process for identifying, prioritizing, and funding model upgrades and corrections?

A2.3.2. Is there a process for notifying users about model bugs, corrections, changes, developments, and plans for future modification or development?

A2.3.3. Are there Version Description Documents?

A2.3.4. Is there a Configuration Control Board?

A2.4. Is there support to the using community?

A2.4.1. Are there regularly scheduled Users' Group meetings?

A2.4.2. Is there ready access to the model developer and maintainer for questions and problems?

A2.4.3. Is there a user training program or plan?

A2.4.4. Are users notified of bugs, changes, developments, and plans for future modification or development?

A2.4.5. Are the data needed to run the model available to the AFAC?

A2.4.6. If data are provided to users, are the sources documented?

A2.5. Is the candidate model readily usable?

A2.5.1. Are the time and resources required to modify the source code reasonable?

A2.5.2. Are the time and resources required to create a scenario, enter data, process data, make model runs, and analyze the results reasonable?

A2.5.3. Once a scenario has been run, is the time needed to run excursions off the baseline run reasonable?

A2.5.4. Are there baseline test cases that produce expected results, and do they cover the operational domain of the model?

A2.5.5. Does the model allow sensitivity analysis across a reasonable range of key inputs?

A2.5.6. Is the cost of the model and required supporting software appropriate for the level of analysis?

A2.5.7. Does the model run on a wide variety of standard platforms?

A2.5.8. Can the model easily operate in a classified environment?

A2.5.9. Does the user-interface minimize data errors and include adequate error-checks?

A2.5.10. Are runtime errors clearly identified and easily fixed?

A2.5.11. Are there intermediate results to aid in error isolation and analysis?

A2.5.12. Is the output well organized and easy to interpret and analyze?

A2.5.13. Can the user easily modify data output, display, and post processing to help the analyst gain an understanding of the underlying model outcomes and establish transparent, traceable cause and effect relationships?

A2.5.14. Can the user trace the logic flow and behavior of key entities?

A2.6. Is there a V&V foundation available for review?

A2.6.1. Is there enough V&V documentation to show what has been done so far?

A2.6.2. Is there a documented V&V plan?

A2.6.3. Are the model's assumptions, algorithms, and modeling approach appropriate?

A2.6.4. Are the model's critical entities and elements represented at a reasonable level of fidelity, detail, and completeness?

A2.6.5. Are the model's logic and representations accepted by subject matter experts?

A2.6.6. Is there a solid basis in theory and experimental data underlying the modeling approach?

A2.6.7. Is there internal validity, i.e., is the model consistent and reliable across runs?

A2.6.8. Are data consistent throughout the model?

A2.6.9. Are model-resident data traceable to accepted lower-level models, standard data sources, or first principles?

A2.6.10. Has the AFAC demonstrated acceptance of the model's results?

A2.6.11. Have the model results been validated against historical or physical test results?

A2.6.12. Are the bounds of the model's domain defined, and is the model accurate across its domain?

A2.7. Have model security vulnerabilities and dependencies been addressed in accordance with AFI 33-202, volume I, *Network and Computer Security***?**

A2.7.1. If to be installed on a network, has the model or simulation been through a DOD-approved security review for vulnerabilities?

A2.7.2. Are identified vulnerabilities made known to the user community?

A2.7.3. What patches, service packs, or updates are required?

A2.7.4. Is there a system for informing the user community about necessary updates?

A2.7.5. Are there limitations on the distribution of model software (e.g., classification, open source licensing, network vulnerabilities)?

A2.7.6. Have all necessary executables, registry settings, and software dependencies been made known to the user community?

A2.7.7. What Open Source or commercial-off-the-shelf software packages are required or recommended to run the model?

A2.7.8. What is the cost to use the model?

Attachment 3

AFSAT MODEL RETIREMENT CRITERIA

A3.1. The model can be replaced by a new, better AFSAT model.

A3.2. The model does not meet the mandatory AFSAT model entry criteria (Attachment 2).

A3.3. The model is no longer an Air Force standard for use in Analyses of Alternatives and other studies supporting senior decision-makers.

A3.4. The model has become unusable or is not being used for Air Force analyses.

A3.5. The model has become cost-prohibitive to own and use.

A3.6. The model management organization has resigned and a replacement cannot be found.

Attachment 4

AFSAT MODEL ENTRY PROCESS DIAGRAM
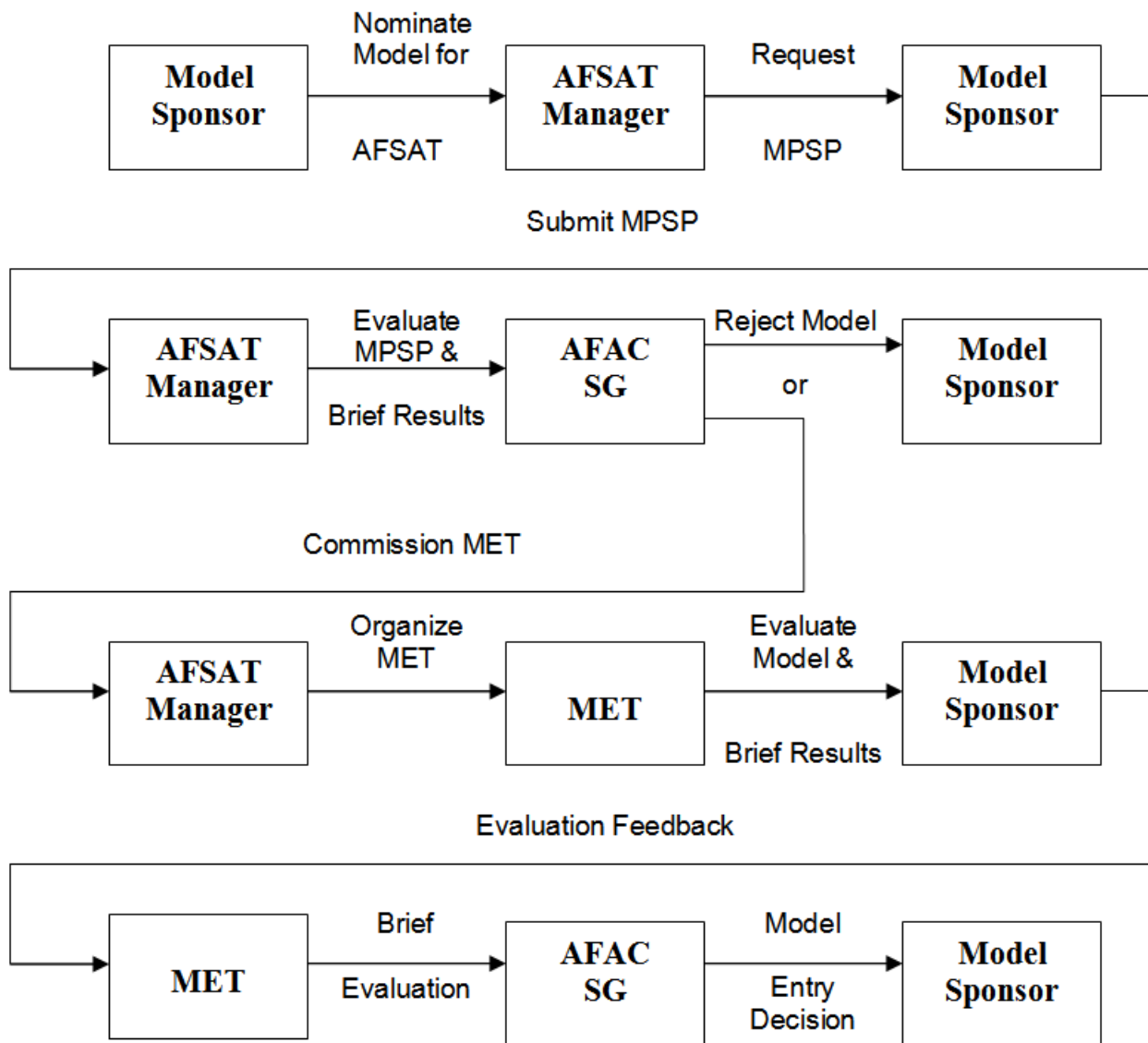
Attachment 5

MODEL PRE-SCREENING PACKAGE CONTENTS

A5.1. Description of model, model capabilities, past uses, model history.

A5.2. List of current model users and model uses.

A5.3. Self-evaluation against AFSAT criteria.

A5.4. User's manual.

A5.5. List of all other available documentation.

A5.6. All V&V reports.